Educating Engineers to Meet the Grand Challenges

Date of Workshop: April 30 and May 1, 2014

Proposing/Participating Entities: EpiCenter
EPICS
Engineers Without Borders-USA
NAE Grand Challenge Scholars Program
National Academy of Engineering
AAES on behalf of its Member Societies

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Background

The Grand Challenges: In 2007, the National Academy of Engineering (NAE) convened a group of leading technological thinkers and doers to consider the NAE Grand Challenges for Engineering for the 21st Century. They identified 14 remarkable goals. Taken together, these objectives reflect the way engineers enable sustainability, health, security and joy of living. Moreover, they underscore how engineering plays a role in addressing all of the Challenges, while making clear that technology alone cannot solve them. Skillsets beyond engineering fundamentals will be necessary, as well as the context of tackling major issues at a global level.

Programs such as EWB-USA, EPICS, EpiCenter and the Grand Challenge Scholars Program, when taken together, provide just such a background -- incorporating entrepreneurship, service learning, hands-on and global experiences as well as perspectives on culture, behavior and policy. The goal of this workshop is to bring those groups together, along with industry, the startup community, and academia, to strengthen each organization and to integrate them into a whole that is greater than the parts. The resulting consortium of engineering schools will commit to incenting students to integrate several curricular and co-curricular experiences in a way that prepares them for taking on the NAE Grand Challenges for Engineering.

Synergy with other reports and initiatives: The President’s Council on Jobs and Competitiveness declared a national goal of graduating 10,000 more engineers a year to meet the needs of US industry and to maintain national economic competitiveness. While industry is asking for more engineers, they are also asking for different kinds of engineers that possess both strong technical skills and a broader set of capabilities that allow them to lead innovation, work across disciplines, and thrive on multi-cultural teams. The NAE described these skills in their report the Engineer of 2020 (NAE, 2004). These characteristics include robust communication, teamwork and leadership skills, along with well-developed social and cultural competencies. Moreover, the scale and timeframe of the NAE Grand Challenges suggest that one cannot expect to know all that is needed over the course of a degree program; rather as suggested in a 2012 UIUC/NAE report, it requires the commitment to and ability for lifelong learning. The American Association of Engineering Societies (AAES) believes that this type of education happens over a lifetime and is making efforts to address some of these same issues.

Presidential support for Grand Challenges: The White House has shown extraordinary support for engineering education and, along with it, Grand Challenge initiatives in such areas as reverse engineering the brain. Tom Kalil, deputy director of the White House Office of Science & Technology Policy, has challenged engineering educators to prepare grand challenge scholars – engineers uniquely prepared with the skillset and mindset to address grand challenges over the
course of their careers. In reference to the NAE Grand Challenge Scholars Program, Kalil said “America needs thousands of students participating in this program.” It is recognized that this kind of integrative preparation is extremely demanding and will not be achievable by every engineering student. Nonetheless, a cadre of specially trained and motivated engineers can be transformative for both global society and the American economy. The goal is for x schools to commit to train y students/year over the next 10 years with x and y on the order of 50 and 20.

It became apparent to the leaders of the programs described above that their efforts needed to be combined in order to respond to the presidential imperative of educating students to address Grand Challenges. Therefore, the teams merged and are proposing a joint summit titled *Educating Engineers to Meet the Grand Challenges*.

**Summary Concept**

The participating groups will build on the efforts of the individual organizations and convene a workshop to include representatives from academia, associations, the startup community, learning through service organizations, and industry to:

1. learn from one another
2. come to agreement on a common path forward
3. identify gaps and plans to address them in order to reach this shared vision.

**When** 1 ½ days (immediately after the NAE Convocation and AAES Spring 2014 functions)

**Where** National Academy of Engineering in Washington, DC (already booked for April 30th and May 1st)

**Who** 60-100 participants, including representatives from:
- Grand Challenge Scholars Programs
- Co-curricular Learning Organizations – including EWB, EPICS, EpiCenter
- Engineering school deans and faculty/directors of relevant programs
- AAES Member Societies – including industry
- The startup community
- National Academy
- Government—including partners in OSTP

**Proposed Structure**
- Professionally facilitated
- At least 1 month ahead: Dissemination of selected readings to level set the knowledge of attendees.
- Morning 1: share data and lessons learned to date
- Afternoon 1: Breakouts to brainstorm gaps
- Morning 2: Identify near- and long-term action plans by sector and/or in partnership

**Deliverables**
1. A Memorandum of Understanding and a commitment of the institutions and organizations to providing their students/members with the key elements of engineering education to prepare them to meet the Grand Challenges. These key elements may include learning through service, global perspectives, practical applications, entrepreneurship, aspects of policy and human behavior.
2. Compilation of existing practices supporting Grand Challenge prep and assessment of learning